



Center for Integrated Nanotechnologies (CINT)

March, 2005 Newsletter

New Faces at CINT

Julia Phillips, CINT Director



Julia Phillips is currently director of the Physical, Chemical, and Nano Sciences Center and has been named director of the Sandia/Los Alamos Center for Integrated Nanotechnologies. She will keep her previous post in addition to the job of running CINT. Says Julia, "The work at CINT represents some of the most exciting scientific research being pursued anywhere. It is breaking down barriers between traditional scientific disciplines and will play a critical role in integrating nanoscience into the technologies of the future."

Antoinette "Toni" Taylor, CINT Associate Director

Toni Taylor assumed the position of Associate Director for the Center for Integrated Nanotechnologies in August 2004. She is widely recognized for her scientific accomplishments in the development and application of laser-based nanoscale probes with over 170 refereed publications to her credit. Toni has been an active member of the CINT Team serving as a Scientific Thrust Leader for Complex Functional Nanomaterials and in 2003 she received the inaugural Los Alamos Fellow's Prize for Outstanding Leadership in Science and Engineering.



Tom Picraux, CINT Chief Scientist

Tom Picraux joined CINT this month from Arizona State University where he was professor and executive director of materials research. He is responsible for CINT science directions and programs. Before his position at ASU Tom worked as Director of the Physical, Chemical and Biomolecular Sciences Center at Sandia National Laboratories. Tom previously received the DOE O.E. Lawrence Award for his work in materials research and has over 250 publications.

Neal Shinn, CINT User Program Manager

Neal Shinn is now the full time CINT User Program Manager. Neal has previously served as Acting CINT Program Manager as well as the Manager of the Surface and Interface Sciences Department at Sandia. Neal will be responsible for CINT collaborative research programs and communications with the external science community.



CINT Announces Third Call for User Proposals

The Center for Integrated Nanotechnologies (CINT) announces its third “jump start” call for user proposals (http://cint.lanl.gov/3rd_call_announcement.shtml). CINT is a Department of Energy, Basic Energy Sciences Nanoscale Science Research Center (NSRC) jointly operated by Los Alamos and Sandia National Laboratories. As part of the national nanoscience infrastructure, CINT provides user access to state-of-the-art equipment, facilities and personnel for nanoscale science and engineering research. Prior to being fully operational in the Spring of 2006, CINT is operating in a “jumpstart” phase that enables some equipment, facilities and personnel of the two sponsoring laboratories to be available to external users through a proposal submission and peer review process. There is no cost to users except for proprietary research.

User Facilities - Under the jump-start program, the CINT user community will have access to tools and capabilities that support CINT’s overall focus on nanoscience integration. Fabrication and synthesis capabilities will allow the user to build and combine synthetic and biological materials and structures across nano to micro length scales. These capabilities include optical and E-beam lithography, patterned semiconductor, oxide and metal deposition and etch, MEMS, μ fluidics, and photonic lattice fabrication, self-assembled nanostructures, nanocrystalline materials, self-assembled monolayer and LB films, semiconductor and metal quantum dots, and protein synthesis. The set of available characterization tools at jump-start include neutron diffraction, small-angle scattering and reflectivity at LANSCE, short-pulse and high magnetic field studies at NHMFL, low-temperature optical and electronic transport measurements, time-resolved optical spectroscopy and microscopy, scanning probe microscopy (AFM, STM, NSOM), and nanoindentation. Users can also apply for access to computer workstations and expertise in modeling that spans first-principles theory to continuum modeling approaches.

Science Focus - Preference will be given to proposals that will utilize CINT expertise and capabilities to address the following topics:

- (1) Integration of top-down fabrication with bottom-up assembly to create new classes of functional materials;
 - (2) Electronic energy transfer, charge transport, fluidic transport, and mechanical properties crossing multiple length scales;
 - (3) Integration of biological and synthetic materials, and control of the interface between biological and non-biological components; and
 - (4) Use or additional development of CINT’s first round of microscale modules being designed to accelerate progress in nanoscience integration and research.
- These modules are referred to as Discovery Platforms™. More information on them can be found in the User Workshop report.

General Users – The scientific community is invited to apply for open, no cost, access to CINT capabilities. Individual and team proposals from industry, academia, and other Laboratories are welcome. Specific instructions for applicants, a description of available jump-start capabilities, and key technical contacts are available on the CINT website (<http://CINT.lanl.gov> or <http://CINT.sandia.gov>). Proposals may request either short-

term (few days) or long-term (weeks to months) access to CINT capabilities. CINT cannot provide financial support to Users.

As CINT will be moving into normal operations in April 2006, this third “jump-start” Call for User Proposals will be limited in the number of new User Proposals accepted. The fourth Call for User Proposals will be issued in the Fall of 2005 for Users to begin work when we commence normal operations in April 2006

Collaborations with CINT scientists at Los Alamos and Sandia National Laboratories are encouraged. Through a separate process, proposals for proprietary use of CINT resources (with full-cost recovery as required by the DOE) will be considered. Foreign National researchers can work at CINT if their visit is planned with sufficient lead-time (see CINT website).

Submission Deadline: May 2, 2005

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Second Round of Jump Start Produces 32 New Projects

An additional 32 new proposals have been added to CINT’s jump start user program. CINT now has 65 nanoscience projects serving researchers from 40 institutions including 22 states and 3 foreign countries. http://cint.lanl.gov/approved_proposals.shtml)

Discovery Platforms™ Initiative

In a new initiative CINT is developing microscale modules for facilitating nanoscience research. These Discovery Platforms™ will be modular micro-laboratories fabricated using MEMS and other technologies for nanoscience experiments. They will be standardized and readily available to CINT users and will be used for measuring electronic, fluidic, mechanical, and other properties of nanomaterials and nanostructures. Each platform will be capable of having multiple signals pass into and out of the nanomaterial so that the specimen can be simultaneously stimulated and interrogated. The rugged, robust platforms will be compatible with a wide range of materials and instruments that will be available at CINT. They will feature parallel architectures so that statistics for nanomaterials can be accumulated in a straightforward manner. And they will feature a controllable environment so that sensitive materials can be protected during study and so that environmental effects can be studied.

CINT scientists and microsystems engineers have identified several platforms for initial development: (1) customizable cantilever platform for nanomechanics research; (2) optical, transport, and photoconductive measurement platform; (3) microfluidic platform for nanomaterials synthesis; (4) 2D photonic lattice platform for nanoelectronics research; and (5) a common package for all platforms. Small teams are working to further define the features of each platform, which will then be designed and fabricated for initial testing. Input from users is welcomed. At least some of these platforms should be ready for users when the new CINT facilities open their doors in the spring of 2006.

Construction Update



CINT gateway at Los Alamos



CINT CORE facility in Albuquerque

The CINT Gateway to Los Alamos has gone vertical! Steel erection on the west half of the building is near completion and all ground floor concrete slabs are complete. Construction of the Core Facility is roughly 50% complete with the south portion of the building being enclosed. The buildings continue to be on schedule for completion in November of 2005.

User workshop January 19-21, 2005

The DOE/BES Center for Integrated Nanotechnologies (CINT) held its third Users Workshop on January 20-21, 2005, at the Marriott Pyramid North Hotel in Albuquerque, NM. Over 218 attendees from academia, industry, small business, federal agencies and national laboratories attended. The broad interest in CINT was reflected in the international participation; 20 countries were represented.

CINT Founding Director, Terry Michalske began the workshop by welcoming the participants. Sandia Vice President, Pace VanDevender and Los Alamos Acting Associate Director for Strategic Research, Micheline Devaurs, followed by describing the importance of CINT to the missions of DOE, Sandia, and LANL. Julie Phillips was introduced as the new CINT Director.

CINT Associate Director Toni Taylor briefed attendees on the new CINT management structure, the building construction, the organizational structure, the special equipment acquisition, thrust areas, description of the science with the 2003 users, introduction of the two new CINT postdocs, overview of the Discovery Platforms™, Jump Start User Programs – including a list of the approved jump start user proposals for 2004, status of

and description of process to full operations in April 2006, and included the achievements and challenges for the next year.

The afternoon focused on the Discovery Platforms™, which are modular microsystems for nanoscience research. For further information, see Discovery Platform™ article by Julie Phillips (this newsletter). Harold Craighead began the afternoon session with a plenary talk on platforms and Bruce Bunker discussed the unique user capabilities available with CINT Discovery Platforms™. ([LINK TO BRUCE'S VG'S](#))

The breakout sessions gave the attendees a chance to learn about Discovery Platforms™, understand how to use them to benefit their nanoscience research, and participate in the design of the platform.

1. Biology/Fluidics Breakout Session. Session leaders were A. Shreve and B. Bunker. The session speakers were Professor Dawn Bonnell, University of Pennsylvania and Dr. Piotr Grodzinski, LANL. (See [\[Biology/Fluidics Breakout Session Summary. LINK TO SUMMARY\].](#))

2. Energy Transport Session. Session leaders were Jerry Simmons and Michael Lilly. Speakers were Professor Charlie Marcus, Harvard University and Dr. Victor Klimov, LANL.

Professor Marcus spoke on “Quantum Circuits” and Dr. Klimov spoke on “Energy Transfer Phenomena.” (See [\[Energy Transport Breakout Session Summary. LINK TO SUMMARY\].](#))

3. Nanomechanics Session. Session leaders were Mike Nastasi and Charles Barbour. Speakers were Professor Andrew Cleland, UC, San Diego and Professor Bill Nix from Stanford University. Professor Cleland spoke on “Integrated Nanomechanical Systems” and Professor Nix, spoke on “Science Issues in Nanomechanics: Mechanical Properties of Materials at the Nanoscale.” (See [\[Nanomechanics Breakout Session Summary. LINK TO SUMMARY\].](#))

4. Electronics and Organic/Inorganic. Session leaders were Sasha Balatsky and Rick Averitt. Speakers were Professor Dmitry Basov, UCSD; Professor Mark Reed, Yale University; and Professor Hiroyuki Tanaka, Osaka University. Professor Basov’s talk described the use of FETs with grid electrode structures to cleanly dope samples. Professor Tanaka’s presentation focused on the ability to pulse inject DNA onto Cu(111) substrates and image the samples using an STM. Professor Reed discussed what CINT should offer as a standard platform for users where the goal is standardization coupled with open access, ease of use, and potential user customization. (See [\[Electronics and Organic/Inorganic Breakout Session Summary. LINK TO SUMMARY\].](#))

5. Synthesis Assembly Session. The Breakout session leaders were Jun Liu and Nelson Bell. Speakers were Professor Paul Braun, Univ. of Illinois, Urbana-Champaign and Professor Yunfeng Lu, Tulane University. Professor Braun gave his talk on coupling self-assembly with complexity, describing the formation of photonic crystals. Professor Lu spoke about efficient synthetic routes to nanomaterials and nanodevices. Professor H.R. Tseng from UCLA Dept. of Medicine spoke for ~10 minutes on the use of

microfluidic networks as micro-reactors to synthesize special molecules used in cancer detection and imaging in the body. [\[Electronics and Organic/Inorganic Breakout Session Summary. LINK TO SUMMARY\]](#)

The CINT jump-start User program was the focus of the second day, beginning with an overview of the Call for User Proposals, capabilities available to users, CINT web-based resources, and electronic proposal submission process by CINT User Program Manager, Neal Shinn. Workshop attendees then engaged CINT scientists in individual discussion during an extended morning Expo session designed to stimulate ideas for User proposals. The formal workshop program concluded with a lunchtime wrap-up session soliciting feedback from the attendees via feedback questionnaires. Informal user discussion continued thereafter.